

Method for supplying occupants of an aircraft with an oxygen-rich gas mixture

5 The present invention relates to a method of supplying occupants of an aircraft with an oxygen-rich gas mixture by air separation in a pressure swing adsorption (PSA) system.

10 On-board systems for generating an oxygen-rich gas mixture, commonly called OBOGS (on-board oxygen generating systems), have been known for several decades for supplying the pilots of military warplanes with oxygen and are beginning to be fitted into civil transport aircraft, as disclosed in document 15 FR-A-2 823 180 in the name of the Applicant.

20 To optimize the ratio of oxygen produced to on-board mass, it has been proposed to use high-performance adsorbents, in particular faujasite-type zeolites modified by digestion or having a high degree of lithium exchange, such as those described in document EP-A-0 297 542 (Chao invention) or EP-A-461 478 (Leavitt invention). In practice, the high-performance adsorbents of this type are used with an intake mixture 25 temperature close to room temperature, below 40°C.

30 The Applicant has found that, in on-board applications, which are necessarily compact and have high flow rates, by optimizing the PSA process it is possible to operate at higher temperatures without, however, reducing performance.

35 Thus, the subject of the invention is a method comprising, in one cycle, a high-pressure adsorption/production phase and a low-pressure desorption/regeneration phase, employing a high-performance adsorbent having a particle size not exceeding 0.8 mm, the duration of the cycle not

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exceeding 10 seconds, and the feed air is introduced at a temperature between 50 and 90°C, typically between 60 and 80°C and advantageously between 60 and 70°C.

5 According to more particular features of the invention:

- the adsorbent, advantageously a zeolite X with a lithium content of greater than 85%, advantageously greater than 90%, has a particle size not exceeding 0.6 mm on average;

10 - the duration of the cycle is between about 5 and 9 seconds;

- typically, the feed air is introduced at a flow rate of between 300 and 400 Sl/min (for the individual supply to a pilot or to a navigator with a useful consumption rate of between 10 and 50 Sl/min under standard temperature and pressure conditions) or between 3300 and 3600 Sl/min (for supply to several rows of passengers of an airliner with a useful consumption rate of between 100 and 500 Sl/min); and

15 - the feed air is introduced at a pressure of less than 5 bar (5×10^5 Pa), the desorption pressure being close to the ambient atmospheric pressure.

20 The Applicant has found that with such adsorption temperatures the kinetics are improved, this being significant in the case of OBOGS, and the yield is also improved.

25 Moreover, the hot feed air makes it possible to moderate the thermal profiles in the adsorbent beds.

30 Finally, since the on-board separation systems are fed with compressed air coming from a compression stage of an aircraft engine with a temperature generally above 150°C, the process according to the invention makes it possible to considerably reduce the size of the exchangers for cooling the feed air, and therefore to save weight and space.

Other features and advantages of the present invention will become apparent from the following description of one embodiment, given by way of illustration but in no way being limiting, in conjunction with the appended drawing in which:

- Figure 1 is a diagram of the installation of an on-board system for supplying an oxygen-rich gas mixture according to the invention.

Recognizable in Figure 1 is a PSA unit 1, comprising at least two adsorbers 2 operating alternately, which receives, from a compressor stage C of the aircraft engine, a stream of compressed hot air, flow-rate controlled at 30 and pressure-controlled in a pressure controller 3, and cooled in a heat exchanger 4, to be separated in the unit 1 into a stream 5 of nitrogen-enriched mixture, used for example to inert compartments or tanks on the aircraft, and a stream 6 of oxygen-enriched mixture that is conveyed, via a regulating valve 7, to user networks 8, for example oxygen masks for the passengers and/or crew.

The gas transfer chain is completed by an inlet mass flow meter 9, an outlet mass flow meter 10, an inlet temperature sensor 11, an inlet pressure sensor 12, an outlet pressure sensor 13 and an oxygen content analyzer 14, these various sensors, connected to a control system (not shown), allowing the flow rates and the pressures along the chain to be adjusted.

In one particular embodiment suitable for supplying commercial aircraft passengers, an oxygen supply subassembly typically comprises two twinned adsorbers 2 operating in alternating cycles and using, as adsorbent, an LiX zeolite having an Si/Al ratio between 1 and 1.25 and exchanged to more than 92% with lithium cations. The intake pressure is about 3 bar for a

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desorption pressure of about 0.5 bar. The flow rate of the intake air is between 3400 and 3500 Sl/min. The temperature of the intake air is between 60 and 65°C and the cycle time is 2 × 4 seconds.

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Although the invention has been described in relation to particular embodiments, it is not limited thereby but is capable of modifications and of variants that will become apparent to those skilled in the art within 10 the context of the claims hereinbelow.